

# 在IOS-XR中配置并检验BGP路径选择

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## 简介

本文档介绍Cisco IOS®-XR中边界网关协议(BGP)的路由策略中的set path-selection<sup>1</sup>语句。

## 背景信息

许多设计旨在让BGP选择并通告一个前缀的多个路径。

默认情况下，仅选择一个BGP路径作为最佳路径，并且仅通告此最佳路径。BGP最佳路径选择算法决定：

### [BGP 最佳路径选择算法](#)

除最佳路径外，还可以选择第二最佳路径作为备份路径。此备份路径可用于BGP PIC（独立于前缀的融合）的设计。

BGP可以安装多条路径以实现负载均衡。这可以是等价多路径(ECMP)负载均衡或非等价多路径(UCMP)。这些多路径安装在路由表(RIB)和数据平面或FIB（转发实例库）表中，以实现负载均衡

。FIB表也称为CEF（思科快速转发）表。

本文重点介绍两个目标：

- 如何让BGP选择要安装的多条路径？
- 如何让BGP通告多条路径？

BGP使用的另一个功能是Additional Paths(ADD-Paths)。此功能允许BGP通过一个BGP会话通告多个路径。

## 摘要

- BGP始终选择最佳路径。如果不是，就是出了点问题。本文不介绍这些场景。
- 如果配置了特定功能（例如BGP PIC），则可以选择备份路径。
- 路由策略可以在特定地址系列下配置，以便BGP选择要安装和/或通告的路径。
- 在Cisco IOS®-XR 7.3.1之前，路由策略中只支持一条set path-selection语句，用于为特定前缀选择路径。
- 从Cisco IOS®-XR 7.3.1开始，路由策略中支持多个set path-selection语句，用于为特定前缀选择路径。
- 从Cisco IOS®-XR 7.3.1开始，添加了一项功能，其中路由策略可用于向一个BGP邻居通告BGP前缀的特定路径。

通过BGP选择多路径是为了接收路径。但是，show bgp命令以字典顺序显示BGP路径。

Cisco IOS®-XR 7.3.1中引入的新命令可用于按接收顺序查看BGP路径：

```
show bgp <afi> rd <rd> <path_details>
```

这有助于验证和排除多路径故障。它解决了为什么选择路径作为多路径而不是另一个路径的主要问题。

多路径保护路径是备份路径，它不是多路径路径，但会保护所有其他多路径路径。

从Cisco IOS®-XR 7.3.1开始，为set path-selection语句提供了新的关键字multipath-protect-advertise。它可用于在备份路径旁或在多路径路径旁通告多路径保护路径。路由策略中使用的完整命令包括：

```
set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise  
set path-selection multipath advertise multipath-protect multipath-protect-advertise
```

这是对set path-selection命令及其所有关键字组合的概述。更详细的说明和示例见下一节。

在以下所有情况下，都安装了最佳路径。如果没有，则出现错误（例如，下一跳无效），但这与set path-selection命令无关。

要选择备份路径，必须为BGP启用一个功能，允许选择BGP备份路径：例如BGP PIC。

在BGP中，通过address family命令maximum-paths启用多路径:

```
maximum-paths {ebgp | eibgp | ibgp} <2-32> (unequal-cost)
```

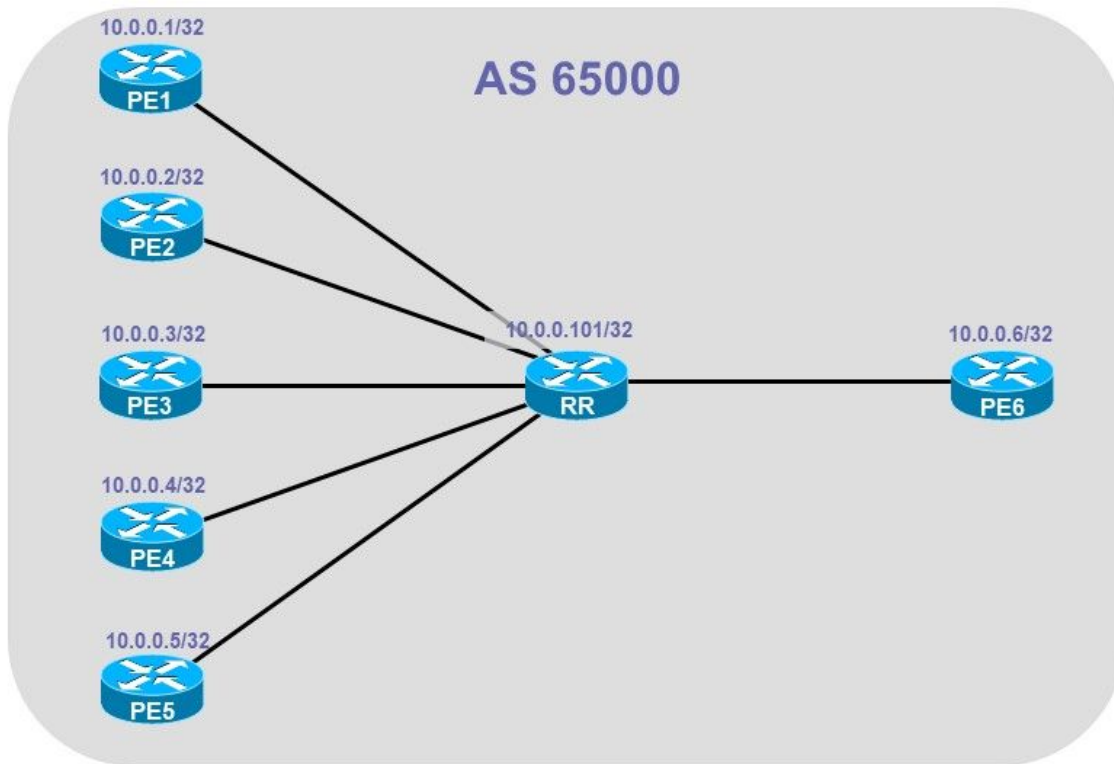
根据定义，最佳路径是多路径。如果未启用BGP的多路径，则最佳路径是路由表中安装的唯一路径。使用命令maximum-paths {ebgp | eibgp | ibgp} <2-32> (非等价)。

下表概述了使用set path-selection命令的所有选项。有关更多详细信息和示例，请参阅下一节中介绍的每个案例。

案例	命令	安装	通告
1	set path-selection backup 1 install	已安装1个备份路径。	仅通告最佳路径。
2	set path-selection backup 1 advertise	未安装备份路径。	将通告备份路径。
3	set path-selection backup 1 advertise install	备份路径已安装。	将通告备份路径。
4	set path-selection all advertise	未安装备份路径。安装多路径。	所有路径都被通告 (最佳路径、备份路径、多路径)。多路径路径)。
5	set path-selection best-path	安装多路径。	仅通告最佳路径。
6	set path-selection multipath advertise	安装多路径。	通告多路径。
7	set path-selection backup 1 install multipath-protect	安装多路径。 如果多路径路径旁仍有路径，则另一路径将作为备份路径("备份 (保护多路径)")路径安装。	仅通告最佳路径。
8	set path-selection backup 1 install multipath-protect advertise	安装多路径。 如果多路径路径旁仍有路径，则另一路径将作为备份路径("备份 (保护多路径)")路径安装。	通告最佳路径和备份路径。不通告备份 (保护多路径) 路径。
9	set path-selection group-	组最佳选择是每个AS和每	通告所有组最佳路径。

	best advertise	下一跳的最佳路径。 安装多路径。	
10	set path-selection backup 1 install multipath-protect advertise multipath- protect-advertise	安装多路径。 如果多路径路径旁仍有路径 , 则另一路径将作为备份路 径("备份 ( 保护多路径 )"路 径安装。	通告最佳路径、备份路 备份 ( 保护多路径 ) 路
11	set path-selection multipath advertise multipath-protect	安装多路径。	通告多路径。 不通告备份 ( 保护多路 ) 路径。
12	set path-selection multipath advertise multipath-protect multipath-protect-advertise	安装多路径。 如果多路径路径旁仍有路径 , 则另一路径将作为备份路 径("备份 ( 保护多路径 )"路 径安装。	通告多路径。 会通告备份 ( 保护多路 ) 路径。

这是本文档中使用的拓扑。



在所有情况下，RR（路由反射器）和PE6之间都启用ADD-PATH。

PE1、PE2、PE3、PE4、PE5和PE6都向RR通告与vpn4单播路由相同的前缀。

PE6是入口PE，从RR接收此前缀。

除非另有说明，否则在每个BGP会话上都启用ADD-PATH，并且在RR上为地址系列vpn4单播配置了maximum-paths ibgp 3。

**注意：**RIB和CEF表中最多安装一个备份路径。不可能/支持多个。该路径在BGP表、RIB表和CEF表中标记为备份。

备份路由始终由BGP在本文中选择。备份路由可以由其他功能选择，但始终为BGP。

如果为BGP配置了多路径，则BGP表中可能安装了多路径（ECMP或UCMP）路径。它们标有多路径。备份路径是第二最佳路径，因此如果有，它应该是多路径路径之一。这意味着，如果配置了此功能，则BGP可以选择备份（保护多路径）（在set path-selection route-policy语句中为multipath-protect关键字）。如果出现这种情况，则此备份（保护多路径）路径是RIB和CEF表中的备份路径。BGP选择并由BGP标记为备份路径的备份路径因此不是备份路径，而只是多路径路径。

如果RR仅具有RR角色，则RR上的备份路由就没什么意义。

在本文中，假设RR也是PE路由器。在这种情况下，选择并安装备份路由确实有意义。备份路由可用于BGP PIC。

指定特定前缀时，备份路由在RIB中标有backup，如果未指定前缀，则标有“！”。

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
  Known via "bgp 65000", distance 200, metric 0
```

```

Number of pic paths 1 , type internal
Installed Sep 17 13:25:25.064 for 00:03:27
Routing Descriptor Blocks
 10.0.0.1, from 10.0.0.1, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.2, from 10.0.0.2, BGP backup path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.3, from 10.0.0.3, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.4, from 10.0.0.4, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
No advertising protos.

```

```
RP/0/RP0/CPU0:RR#show route vrf one
```

```

Codes: C - connected, S - static, R - RIP, B - BGP, (>) - Diversion path
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - ISIS, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, su - IS-IS summary null, * - candidate default
       U - per-user static route, o - ODR, L - local, G - DAGR, l - LISP
       A - access/subscriber, a - Application route
       M - mobile route, r - RPL, t - Traffic Engineering, (!) - FRR Backup path

```

```
Gateway of last resort is not set
```

```

B    10.1.1.1/32 [200/0] via 10.0.0.1 (nexthop in vrf default), 00:02:16
      [200/0] via 10.0.0.2 (nexthop in vrf default), 00:02:16 (!)
      [200/0] via 10.0.0.3 (nexthop in vrf default), 00:02:16
      [200/0] via 10.0.0.4 (nexthop in vrf default), 00:02:16

```

## 在路由策略中设置路径选择命令

本部分介绍在路由器BGP下特定地址系列的路由策略中使用的所有set path-selection语句。

这与Cisco IOS®XR版本在Cisco IOS®-XR 7.3.1之前或之后无关。

配置:

```

router bgp 65000
 address-family ipv4 unicast
  !
 address-family vpnv4 unicast
 additional-paths receive
 additional-paths send
 additional-paths selection route-policy BGP-Path-Selection
  !
 neighbor 10.0.0.1
 remote-as 65000
 update-source Loopback0
 address-family ipv4 unicast
  route-reflector-client
  !
 address-family vpnv4 unicast
  route-reflector-client

```

```

!
!
neighbor 10.0.0.2
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
  route-reflector-client
!
address-family vpnv4 unicast
  route-reflector-client
!
!
neighbor 10.0.0.3
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
  route-reflector-client
!
address-family vpnv4 unicast
  route-reflector-client
!
!
neighbor 10.0.0.4
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
  route-reflector-client
!
address-family vpnv4 unicast
  route-reflector-client
!
!
neighbor 10.0.0.5
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
  route-reflector-client
!
address-family vpnv4 unicast
  route-reflector-client
!
!
neighbor 10.0.0.6
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
  route-reflector-client
!
address-family vpnv4 unicast
  route-reflector-client
!
!
vrf one
rd 1:1
address-family ipv4 unicast
  maximum-paths ibgp 3
  additional-paths selection route-policy BGP-Path-Selection
  redistribute connected
!
!
!

```

具有set path-selection语句的路由策略应用于address-family vpnv4单播下。

具有set path-selection语句的路由策略也应用于VRF。如果备份路由需要安装在VRF RIB/CEF表中 ( 或通过PE-CE链路在BGP会话上通告 ) , 则需要这样做。

在这里, 两个路由策略是相同的, 但不同的路由策略可以应用在地址系列下, 而不是VRF下。

VRF one下使用Maximum-path *ibgp 3*, 指定RIB/CEF表中最多可以有三个ECMP路径。

这些情况显示了具有设置路径选择的路由策略的所有可能性。

## 1.set path-selection backup 1 install

```
route-policy BGP-Path-Selection
  set path-selection backup 1 install
end-policy
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

```
Last Modified: Sep 17 13:14:35.907 for 00:04:41
```

```
Paths: (5 available, best #1)
```

```
Advertised to update-groups (with more than one peer):
 0.2 0.3
```

```
Path #1: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
 0.2 0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
```

```
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 1, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
```

```
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 2, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #3: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
Received Path ID 0, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #4: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```



```
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 0, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:
```

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
```

```
Routing entry for 10.1.1.1/32
  Known via "bgp 65000", distance 200, metric 0
  Number of pic paths 1 , type internal
  Installed Sep 17 13:25:25.064 for 00:03:27
Routing Descriptor Blocks
  10.0.0.1, from 10.0.0.1, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.2, from 10.0.0.2, BGP backup path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.3, from 10.0.0.3, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.4, from 10.0.0.4, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
No advertising protos.
```

```
RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
```

```
10.1.1.1/32, version 119, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e10a8)
Updated Sep 17 13:25:25.068
Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
    path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2730
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.1/32 via 24003/0/21
      next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
    path-idx 1 NHID 0x0 [0xdab2e48 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.2/32 via 24001/0/21
      next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
    path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2550
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.3/32 via 24007/0/21
      next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
    path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2190
    recursion-via-/32
```

```
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.4/32 via 24000/0/21
next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}
```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          87        87
Last Modified: Sep 17 13:50:32.649 for 00:00:42
Paths: (1 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  Not advertised to any peer
Local
  10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
    Received Path ID 1, Local Path ID 1, version 87
    Extended community: RT:65000:1
    Originator: 10.0.0.1, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

结论:VRF的RR上安装了1个备份路径。仅通告最佳路径。

## 2.set path-selection backup 1 advertise

```
route-policy BGP-Path-Selection
  set path-selection backup 1 advertise
end-policy
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          5         5
Last Modified: Sep 17 13:38:03.907 for 00:02:04
Paths: (5 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.2 0.3
Local, (Received from a RR-client)
  10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
    Received Path ID 0, Local Path ID 1, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.3
Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
    Received Label 24012
```

```

Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
Received Path ID 0, Local Path ID 2, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
Received Label 24012
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
Received Path ID 0, Local Path ID 0, version 0
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
Received Label 24013
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
Received Path ID 0, Local Path ID 0, version 0
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
Received Label 24014
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
Received Path ID 1, Local Path ID 0, version 0
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

```

Routing entry for 10.1.1.1/32
Known via "bgp 65000", distance 200, metric 0, type internal
Installed Sep 17 13:38:04.233 for 00:04:26
Routing Descriptor Blocks
10.0.0.1, from 10.0.0.1, BGP multi path
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
  Route metric is 0
10.0.0.2, from 10.0.0.2, BGP multi path
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
  Route metric is 0
10.0.0.4, from 10.0.0.4, BGP multi path
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
  Route metric is 0
No advertising protos.

```

RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**

```

10.1.1.1/32, version 135, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696158)
Updated Sep 17 13:38:04.236
Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
  next hop 10.1.101.1/32 Gi0/0/0 labels imposed {ImplNull 24012}
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]

```

```

recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.2/32 via 24001/0/21
  next hop 10.2.101.2/32 Gi0/0/0/4   labels imposed {ImplNull 24012}
via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
path-idx 2 NHID 0x0 [0xdab2c98 0x0]
recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.4/32 via 24000/0/21
  next hop 10.4.101.4/32 Gi0/0/0/7   labels imposed {ImplNull 24013}

```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	73	73

Last Modified: Sep 17 13:38:05.649 for 00:02:47

Paths: (2 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 73

Extended community: RT:65000:1

Originator: 10.0.0.1, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local

10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 2, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.2, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

结论:未安装备份路由。将通告备份路径。

### 3.set path-selection backup 1 advertise install

```
route-policy BGP-Path-Selection
```

```
  set path-selection backup 1 advertise install
```

```
end-policy
```

```
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 17 14:20:36.907 for 00:01:55

Paths: (5 available, best #1)

```

Advertised to update-groups (with more than one peer):
 0.2 0.3
Path #1: Received by speaker 0
Advertised to update-groups (with more than one peer):
 0.2 0.3
Local, (Received from a RR-client)
 10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
   Received Path ID 0, Local Path ID 1, version 5
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Advertised to update-groups (with more than one peer):
 0.3
Local, (Received from a RR-client)
 10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
   Received Path ID 0, Local Path ID 2, version 5
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
 10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 0, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
 10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
   Received Label 24013
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 0, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
 10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
   Received Label 24014
   Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
   Received Path ID 1, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

Routing entry for 10.1.1.1/32

Known via "bgp 65000", distance 200, metric 0

Number of pic paths 1 , type internal

Installed Sep 17 14:23:42.997 for 00:00:59

Routing Descriptor Blocks

10.0.0.1, from 10.0.0.1, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.2, from 10.0.0.2, **BGP backup path**

```
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
Route metric is 0
10.0.0.3, from 10.0.0.3, BGP multi path
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
Route metric is 0
10.0.0.5, from 10.0.0.5, BGP multi path
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
Route metric is 0
No advertising protos.
```

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 185, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e10a8)

Updated Sep 17 14:23:42.999

```
Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2730
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}
via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2550
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}
via 10.0.0.5/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 3 NHID 0x0 [0xdab2368 0x0], Internal 0xd6a2190
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.5/32 via 24005/0/21
    next hop 10.5.101.5/32 Gi0/0/0/1 labels imposed {ImplNull 24014}
```

检验通告的路径：

RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```
Process          bRIB/RIB  SendTblVer
Speaker          105      105
```

Last Modified: Sep 17 14:23:43.649 for 00:02:16

Paths: (2 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 105

Extended community: RT:65000:1

Originator: 10.0.0.1, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local

10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 2, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.2, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

结论:已安装备份路由。将通告备份路径。这是1和2。

## 4.set path-selection all advertise

```
route-policy BGP-Path-Selection
```

```
  set path-selection all advertise
```

```
end-policy
```

```
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 17 14:28:58.907 for 00:04:04

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.2 0.3

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2 0.3

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**,

import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 4, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

Path #4: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.2
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, add-path, import-candidate,
imported
    Received Path ID 0, Local Path ID 3, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.2
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
    Received Path ID 1, Local Path ID 5, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

```

Routing entry for 10.1.1.1/32
Known via "bgp 65000", distance 200, metric 0, type internal
Installed Sep 17 14:28:59.169 for 00:04:52
Routing Descriptor Blocks
  10.0.0.1, from 10.0.0.1, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.2, from 10.0.0.2, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.5, from 10.0.0.5, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
No advertising protos.

```

RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**

```

10.1.1.1/32, version 201, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696158)
Updated Sep 17 14:28:59.175
Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}
via 10.0.0.5/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 2 NHID 0x0 [0xdab2368 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.5/32 via 24005/0/21
    next hop 10.5.101.5/32 Gi0/0/0/1 labels imposed {ImplNull 24014}

```

**检验通告的路径：**



RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	125	125

Last Modified: Sep 17 14:29:00.649 for 00:02:21

Paths: (5 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 125

Extended community: RT:65000:1

Originator: 10.0.0.1, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local

10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 2, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.3, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local

10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 3, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.4, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Not advertised to any peer

Local

10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 4, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.2, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #5: Received by speaker 0

Not advertised to any peer

Local

10.0.0.5 (metric 3) from 10.0.0.101 (10.0.0.5)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 5, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.5, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

结论:未安装备份路由。通告所有(5)条路径。

## 5.set path-selection best-path

```
route-policy BGP-Path-Selection
  set path-selection best-path
end-policy
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions: Process          bRIB/RIB  SendTblVer
```

```
Speaker          5          5
```

```
Last Modified: Sep 17 15:34:15.907 for 00:00:09
```

```
Paths: (5 available, best #1)
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Path #1: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
```

```
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 1, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
```

```
imported
```

```
Received Path ID 0, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #3: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
```

```
imported
```

```
Received Path ID 0, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #4: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
```

```
Received Label 24013
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
Received Path ID 0, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #5: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
```

```
Received Label 24014
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
Received Path ID 1, Local Path ID 0, version 0
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
```

```
Routing entry for 10.1.1.1/32
```

```
Known via "bgp 65000", distance 200, metric 0, type internal
```

```
Installed Sep 17 15:34:16.311 for 00:00:28
```

```
Routing Descriptor Blocks
```

```
10.0.0.1, from 10.0.0.1, BGP multi path
```

```
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
Route metric is 0
```

```
10.0.0.2, from 10.0.0.2, BGP multi path
```

```
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
Route metric is 0
```

```
10.0.0.3, from 10.0.0.3, BGP multi path
```

```
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
Route metric is 0
```

```
No advertising protos.
```

```
RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
```

```
10.1.1.1/32, version 215, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf696100)
```

```
Updated Sep 17 15:34:16.313
```

```
Prefix Len 32, traffic index 0, precedence n/a, priority 3
```

```
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
```

```
recursion-via-/32
```

```
next hop VRF - 'default', table - 0xe0000000
```

```
next hop 10.0.0.1/32 via 24003/0/21
```

```
next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
```

```
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
path-idx 1 NHID 0x0 [0xdab2e48 0x0]
```

```
recursion-via-/32
```

```
next hop VRF - 'default', table - 0xe0000000
```

```
next hop 10.0.0.2/32 via 24001/0/21
```

```
next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}
```

```
via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
path-idx 2 NHID 0x0 [0xdab2060 0x0]
```

```
recursion-via-/32
```

```
next hop VRF - 'default', table - 0xe0000000
```

```
next hop 10.0.0.3/32 via 24007/0/21
```

```
next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}
```

结论:仅安装最佳路径和多路径。仅通告最佳路径。未选择、安装或通告备份路径。

## 6.set path-selection multipath advertise

通告是必需的关键字。

```
route-policy BGP-Path-Selection
```

```
set path-selection multipath advertise
```

```
end-policy
```

要使此功能正常运行，必须为特定地址系列的BGP启用多路径。

在此，VRF 1中ipv4单播的多路径已启用。

```
router bgp 65000
```

```
vrf one
rd 1:1
address-family ipv4 unicast
  maximum-paths ibgp 3
  additional-paths selection route-policy BGP-Path-Selection
  redistribute connected
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

```
Last Modified: Sep 17 15:40:15.907 for 00:00:28
```

```
Paths: (5 available, best #1)
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Path #1: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,  
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 1, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
```

```
0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-  
candidate, imported
```

```
Received Path ID 0, Local Path ID 3, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #3: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
Received Path ID 0, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #4: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
```

```
0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
```

```
Received Label 24013
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-  
candidate, imported
```

```
Received Path ID 0, Local Path ID 2, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #5: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
```

Received Label 24014  
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported  
Received Path ID 1, Local Path ID 0, version 0  
Extended community: RT:65000:1  
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

Routing entry for 10.1.1.1/32  
Known via "bgp 65000", distance 200, metric 0, type internal  
Installed Sep 17 15:40:16.152 for 00:01:11  
Routing Descriptor Blocks  
 10.0.0.1, from 10.0.0.1, **BGP multi path**  
 Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
 Route metric is 0  
 10.0.0.2, from 10.0.0.2, **BGP multi path**  
 Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
 Route metric is 0  
 10.0.0.4, from 10.0.0.4, **BGP multi path**  
 Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
 Route metric is 0  
No advertising protos.

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 229, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf6961b0)  
Updated Sep 17 15:40:16.156  
Prefix Len 32, traffic index 0, precedence n/a, priority 3  
via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
 path-idx 0 NHID 0x0 [0xdab2bc0 0x0]  
 recursion-via-/32  
 next hop VRF - 'default', table - 0xe0000000  
 next hop 10.0.0.1/32 via 24003/0/21  
 next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}  
via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
 path-idx 1 NHID 0x0 [0xdab2e48 0x0]  
 recursion-via-/32  
 next hop VRF - 'default', table - 0xe0000000  
 next hop 10.0.0.2/32 via 24001/0/21  
 next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}  
via 10.0.0.4/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
 path-idx 2 NHID 0x0 [0xdab2c98 0x0]  
 recursion-via-/32  
 next hop VRF - 'default', table - 0xe0000000  
 next hop 10.0.0.4/32 via 24000/0/21  
 next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}

检验通告的路径：

RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	153	153

Last Modified: Sep 17 15:40:17.649 for 00:02:08

Paths: (3 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-

```

candidate, imported
  Received Path ID 1, Local Path ID 1, version 153
  Extended community: RT:65000:1
  Originator: 10.0.0.1, Cluster list: 10.0.0.101
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 2, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Originator: 10.0.0.4, Cluster list: 10.0.0.101
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 3, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Originator: 10.0.0.2, Cluster list: 10.0.0.101
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

- vpnv4路径标有多路径。
- 3条多路径安装在RIB中。
- 通告3条多路径。
- 没有备份路径。

结论:多路径安装在RIB中并通告。未选择、安装或通告备份。

## 7. set path-selection backup 1 install multipath-protect

```

route-policy BGP-Path-Selection
  set path-selection backup 1 install multipath-protect
end-policy

```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          5         5
Last Modified: Sep 17 15:46:17.907 for 00:04:59
Paths: (5 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Local, (Received from a RR-client)
    10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
    Received Path ID 0, Local Path ID 1, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0

```

```

Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
    Received Path ID 0, Local Path ID 2, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
    Received Path ID 0, Local Path ID 3, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
    Received Path ID 0, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

Routing entry for 10.1.1.1/32

Known via "bgp 65000", distance 200, metric 0

Number of pic paths 1 , type internal

Installed Sep 17 15:46:17.904 for 00:05:14

Routing Descriptor Blocks

10.0.0.1, from 10.0.0.1, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.2, from 10.0.0.2, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.3, from 10.0.0.3, **BGP backup path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.4, from 10.0.0.4, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

No advertising protos.

RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**

10.1.1.1/32, version 249, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e10a8)

Updated Sep 17 15:46:17.907

```

Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
via 10.0.0.3/32, 2 dependencies, recursive, backup [flags 0x6100]
  path-idx 2 NHID 0x0 [0xdab2060 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2730
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}

```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```

Process          bRIB/RIB  SendTblVer
Speaker          163      163

```

Last Modified: Sep 17 15:46:18.649 for 00:07:36

Paths: (1 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 163

Extended community: RT:65000:1

Originator: 10.0.0.1, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

可能没有备份(保护多路径)路径。例如，如果配置了BGP最大路径2，并且只接收2条路径，则两条路径是多路径，并且没有备份(保护多路径)路径。

结论:所有多路径都安装在RIB中。另一条路径作为备份路径(备份(保护多路径)路径)。仅通告最佳路径。

## 8.set path-selection backup 1 install multipath-protect advertise

```
route-policy BGP-Path-Selection
```

```
  set path-selection backup 1 install multipath-protect advertise
```

```
end-policy
```



RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 17 16:03:00.907 for 00:01:19

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.2 0.3

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2 0.3

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.3

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 3, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #5: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 1, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

Routing entry for 10.1.1.1/32

Known via "bgp 65000", distance 200, metric 0

Number of pic paths 1 , type internal

Installed Sep 17 16:03:01.199 for 00:05:13

Routing Descriptor Blocks

10.0.0.1, from 10.0.0.1, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.2, from 10.0.0.2, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.3, from 10.0.0.3, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.4, from 10.0.0.4, **BGP backup path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

No advertising protos.

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 281, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e1108)

Updated Sep 17 16:03:01.206

Prefix Len 32, traffic index 0, precedence n/a, priority 3

via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.1/32 via 24003/0/21

next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}

via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.2/32 via 24001/0/21

next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}

via 10.0.0.3/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2910

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.3/32 via 24007/0/21

next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}

via 10.0.0.4/32, 2 dependencies, recursive, **backup** [flags 0x6100]

path-idx 3 NHID 0x0 [0xdab2c98 0x0]

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.4/32 via 24000/0/21

next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}

检验通告的路径：

RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process bRIB/RIB SendTblVer

Speaker 181 181

Last Modified: Sep 17 16:03:02.649 for 00:07:39

Paths: (2 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

```

Local
 10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
   Received Path ID 1, Local Path ID 1, version 181
   Extended community: RT:65000:1
   Originator: 10.0.0.1, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Not advertised to any peer
Local
 10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 2, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Originator: 10.0.0.2, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

- 有三条多路径。
- 有一个“备份 ( 保护多路径 )”路径。这是RIB/CEF表中安装的备份路径。
- 第五条路径未标记。
- 通告最佳路径和备份路径。

可能没有备份(保护多路径)路径。例如，如果配置了BGP最大路径2，并且只接收2条路径，则两条路径是多路径，并且没有备份 ( 保护多路径 ) 路径。

此通告的备份路径是多路径路径之一 ( 在BGP表中标记为备份 )。

这是最大路径ibgp 1:

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB   SendTblVer
  Speaker          5          5
Last Modified: Sep 17 16:15:48.907 for 00:00:44
Paths: (5 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Local, (Received from a RR-client)
    10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.2
  Local, (Received from a RR-client)
    10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, backup, add-path, import-
candidate, imported

```

```

Received Path ID 0, Local Path ID 2, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 0, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 0, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

```

Routing entry for 10.1.1.1/32
Known via "bgp 65000", distance 200, metric 0
Number of pic paths 1 , type internal
Installed Sep 17 16:15:48.900 for 00:01:28
Routing Descriptor Blocks
  10.0.0.1, from 10.0.0.1
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.2, from 10.0.0.2, BGP backup path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
No advertising protos.

```

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

```

10.1.1.1/32, version 297, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf6960a8)
Updated Sep 17 16:15:48.903
Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive [flags 0x6000]
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}

```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
Speaker          189      189
```

```
Last Modified: Sep 17 16:15:50.649 for 00:02:10
```

```
Paths: (2 available, best #1)
```

```
Not advertised to any peer
```

```
Path #1: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```

```
10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported
```

```
Received Path ID 1, Local Path ID 1, version 189
```

```
Extended community: RT:65000:1
```

```
Originator: 10.0.0.1, Cluster list: 10.0.0.101
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```

```
10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
Received Path ID 2, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Originator: 10.0.0.2, Cluster list: 10.0.0.101
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- RR上没有ECMP。
- 第二个最佳路径是备份路径。它安装在RIB/CEF表中。
- 通告最佳路径和备份路径。
- 没有备份 ( 保护多路径 ) 路径。

结论:所有多路径都安装在RIB中。另一条路径将作为备份路径安装。通告最佳路径和备份路径。

## 9.set path-selection group-best advertise

- Group-best只能与通告一起使用。
- 组最佳选择是每个AS ( 自治系统 ) 和每下一跳的最佳路径。
- 前缀来自不同的自治系统。

本例使用不同的拓扑。路由器与映像1中的路由器相同，但PE4现在位于AS 65004中，PE5现在位于AS 65005中。所有其他路由器仍位于AS 65000中。

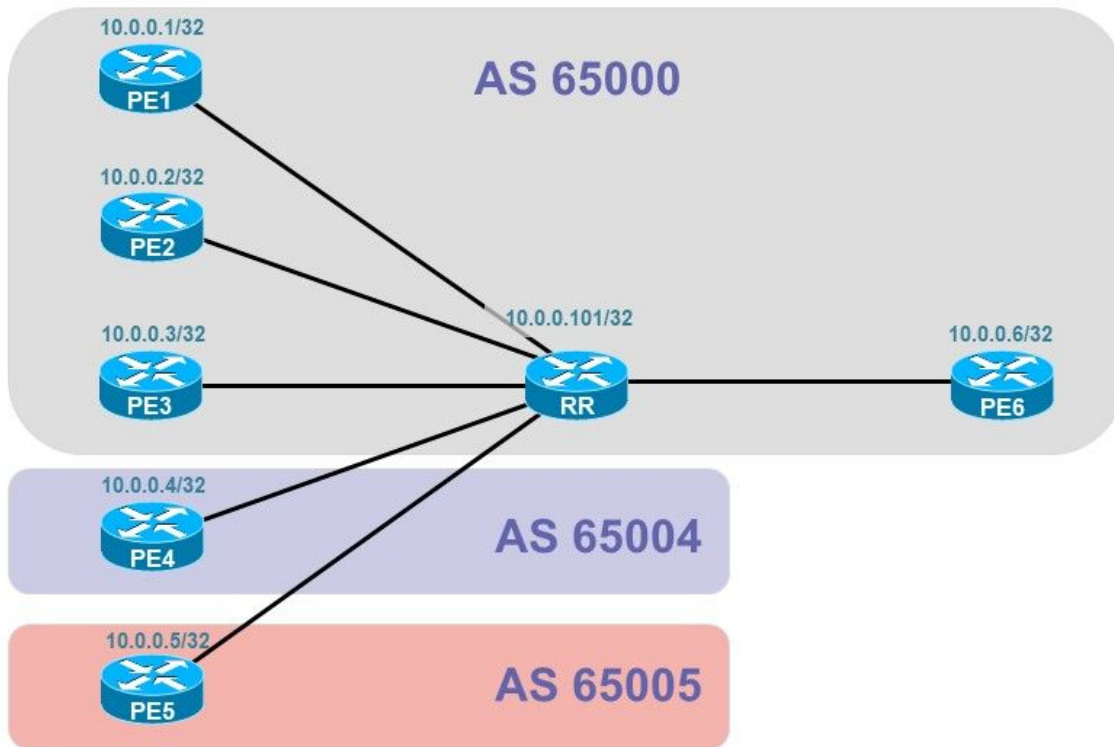


图2

这意味着现在RR和PE4之间以及RR和PE5之间有eBGP会话。

```
route-policy BGP-Path-Selection
  set path-selection group-best advertise
end-policy
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Local Label: 24010

Last Modified: Sep 21 06:06:29.117 for 00:02:18

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.3 0.4

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.3 0.4

**Local**, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, **group-best**, **multipath**,

import-candidate, imported

Received Path ID 1, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

**Local**, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, import-candidate,

```

imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
  Received Label 24014
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.4
65004
  10.4.101.4 from 10.4.101.4 (10.0.0.4)
  Received Label 24015
  Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
  Received Path ID 0, Local Path ID 2, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.4
65005
  10.5.101.5 from 10.5.101.5 (10.0.0.5)
  Received Label 24014
  Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
  Received Path ID 0, Local Path ID 3, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

```

Routing entry for 10.1.1.1/32
Known via "bgp 65000", distance 200, metric 0, type internal
Installed Sep 20 19:59:07.762 for 10:00:40
Routing Descriptor Blocks
  10.0.0.1, from 10.0.0.1, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.2, from 10.0.0.2, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
  10.0.0.3, from 10.0.0.3, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
No advertising protos.

```

RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**

```

10.1.1.1/32, version 114, internal 0x1000001 0x30 (ptr 0xd96a338) [1], 0x0 (0xe366530), 0xa08
(0xf69e0a8)
Updated Sep 20 19:59:07.765
Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab1b98 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24008/0/21

```

```

local label 24010
next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24014}
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
path-idx 1 NHID 0x0 [0xdab30d0 0x0]
recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.2/32 via 24000/0/21
local label 24010
next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24014}
via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
path-idx 2 NHID 0x0 [0xdab2918 0x0]
recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.3/32 via 24002/0/21
local label 24010
next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24014}

```

RR在RIB和CEF表中仍安装有三条ECMP路径。

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```

Process          bRIB/RIB  SendTblVer
Speaker          47        47

```

Last Modified: Sep 20 19:59:07.588 for 09:59:44

Paths: (3 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.3 (metric 5) from 10.0.0.101 (10.0.0.3)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 47

Extended community: RT:65000:1

Originator: 10.0.0.3, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

65004

10.4.101.4 (metric 3) from 10.0.0.101 (10.0.0.101)

Received Label 24010

Origin incomplete, metric 0, localpref 100, valid, internal, group-best, import-candidate, imported

Received Path ID 2, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

65005

10.5.101.5 (metric 2) from 10.0.0.101 (10.0.0.101)

Received Label 24010

Origin incomplete, metric 0, localpref 100, valid, internal, group-best, import-candidate, imported

Received Path ID 3, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RR从从AS 65000接收的三条路径通告组最佳路径。除此路径外，RR还通告从AS 65004接收的组最佳路径和从AS 65005接收的组最佳路径。



有三条组最佳路径，因为三条路径具有不同的邻居AS。所有这些路径都会通告。不通告多路径。

结论:通告所有组最佳路径。

## 10. set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise

此选项仅从Cisco IOS®-XR 7.3.1开始可用。

从Cisco IOS®-XR 7.3.1开始，有一个新关键字multipath-protect-advertise。

这允许在备份路径旁通告多路径保护路径。在Cisco IOS®-XR 7.3.1之前，已安装多路径保护路径，但未通告。（见案例8。）

```
route-policy BGP-Path-Selection
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 17 16:43:05.907 for 00:01:14

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.2 0.3

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2 0.3

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.3

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 0, version 0

Extended community: RT:65000:1  
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1  
Path #4: Received by speaker 0  
Advertised to update-groups (with more than one peer):  
0.3  
Local, (Received from a RR-client)  
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)  
Received Label 24013  
Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,  
add-path, import-candidate, imported  
Received Path ID 0, Local Path ID 3, version 5  
Extended community: RT:65000:1  
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1  
Path #5: Received by speaker 0  
Not advertised to any peer  
Local, (Received from a RR-client)  
10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)  
Received Label 24014  
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported  
Received Path ID 1, Local Path ID 0, version 0  
Extended community: RT:65000:1  
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1

Routing entry for 10.1.1.1/32  
Known via "bgp 65000", distance 200, metric 0  
Number of pic paths 1 , type internal  
Installed Sep 17 16:43:05.562 for 00:01:45  
Routing Descriptor Blocks  
10.0.0.1, from 10.0.0.1, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.2, from 10.0.0.2, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.3, from 10.0.0.3, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.4, from 10.0.0.4, **BGP backup path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
No advertising protos.

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1

10.1.1.1/32, version 323, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08  
(0xf4e1168)  
Updated Sep 17 16:43:05.567  
Prefix Len 32, traffic index 0, precedence n/a, priority 3  
via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.1/32 via 24003/0/21  
next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}  
via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2730  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.2/32 via 24001/0/21  
next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}  
via 10.0.0.3/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2910  
recursion-via-/32

```

next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.3/32 via 24007/0/21
  next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
via 10.0.0.4/32, 2 dependencies, recursive, backup [flags 0x6100]
path-idx 3 NHID 0x0 [0xdab2c98 0x0]
recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.4/32 via 24000/0/21
  next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}

```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```

Process          bRIB/RIB  SendTblVer
Speaker          207      207

```

Last Modified: Sep 17 16:43:06.649 for 00:02:31

Paths: (3 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 1, Local Path ID 1, version 207

Extended community: RT:65000:1

Originator: 10.0.0.1, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local

10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 2, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.2, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local

10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 3, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.4, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

结论:所有多路径都安装在RIB中。另一个路径 — **backup(protect multipath) path** — 作为备份路径安装。通告最佳路径、备份路径和备份(保护多路径)路径。

## 11.设置路径选择多路径通告多路径保护

此选项仅从Cisco IOS®-XR 7.3.1开始可用。

```
route-policy BGP-Path-Selection
```

```
set path-selection multipath advertise multipath-protect
end-policy
!
```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

```
Last Modified: Sep 18 06:12:25.907 for 00:00:12
```

```
Paths: (5 available, best #1)
```

```
Advertised to update-groups (with more than one peer):
0.2 0.3
```

```
Path #1: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
0.2 0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 1, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
```

```
Received Path ID 0, Local Path ID 3, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #3: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
```

```
Received Path ID 0, Local Path ID 4, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #4: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
```

```
Received Label 24013
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
```

```
Received Path ID 0, Local Path ID 2, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #5: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
```

```
Received Label 24014
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

Received Path ID 1, Local Path ID 0, version 0  
Extended community: RT:65000:1  
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

Routing entry for 10.1.1.1/32  
Known via "bgp 65000", distance 200, metric 0  
Number of pic paths 1 , type internal  
Installed Sep 18 06:12:26.137 for 00:05:23  
Routing Descriptor Blocks  
10.0.0.1, from 10.0.0.1, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.2, from 10.0.0.2, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.3, from 10.0.0.3, **BGP backup path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
10.0.0.4, from 10.0.0.4, **BGP multi path**  
Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000  
Route metric is 0  
No advertising protos.

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 345, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e1108)  
Updated Sep 18 06:12:26.140  
Prefix Len 32, traffic index 0, precedence n/a, priority 3  
via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.1/32 via 24003/0/21  
next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}  
via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2730  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.2/32 via 24001/0/21  
next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}  
via 10.0.0.3/32, 2 dependencies, recursive, **backup** [flags 0x6100]  
path-idx 2 NHID 0x0 [0xdab2060 0x0]  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.3/32 via 24007/0/21  
next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}  
via 10.0.0.4/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]  
path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2550  
recursion-via-/32  
next hop VRF - 'default', table - 0xe0000000  
next hop 10.0.0.4/32 via 24000/0/21  
next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}

检验通告的路径：

RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	221	221

Last Modified: Sep 18 06:12:27.649 for 00:01:38

```

Paths: (3 available, best #1)
Not advertised to any peer
Path #1: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
    Received Path ID 1, Local Path ID 1, version 221
    Extended community: RT:65000:1
    Originator: 10.0.0.1, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 2, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Originator: 10.0.0.4, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 3, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Originator: 10.0.0.2, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

- 第三条路径是备份路径。它在BGP中标记为备份（保护多路径），并作为备份路径安装在RIB中。
- 通告最佳路径和多路径。
- 不通告“backup(protect multipath)”路径。

## 12. set path-selection multipath advertise multipath-protect multipath-protect-advertise

这允许在多路径旁安装和通告多路径保护路径。

```

route-policy BGP-Path-Selection
  set path-selection multipath advertise multipath-protect multipath-protect-advertise
end-policy

```

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          5         5
Last Modified: Sep 18 06:22:22.907 for 00:03:12
Paths: (5 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.2 0.3
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):

```

```

0.2 0.3
Local, (Received from a RR-client)
  10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
    Received Path ID 0, Local Path ID 1, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.2
Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
    Received Path ID 0, Local Path ID 4, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 0, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.2
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
    Received Path ID 0, Local Path ID 2, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.2
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
    Received Path ID 1, Local Path ID 3, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**

Routing entry for 10.1.1.1/32

Known via "bgp 65000", distance 200, metric 0

Number of pic paths 1 , type internal

Installed Sep 18 06:22:23.059 for 00:03:34

Routing Descriptor Blocks

10.0.0.1, from 10.0.0.1, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.2, from 10.0.0.2, **BGP backup path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

```
Route metric is 0
10.0.0.4, from 10.0.0.4, BGP multi path
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
  Route metric is 0
10.0.0.5, from 10.0.0.5, BGP multi path
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
  Route metric is 0
No advertising protos.
```

```
RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
```

```
10.1.1.1/32, version 367, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e11c8)
```

```
Updated Sep 18 06:22:23.062
```

```
Prefix Len 32, traffic index 0, precedence n/a, priority 3
```

```
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
  path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
```

```
  recursion-via-/32
```

```
  next hop VRF - 'default', table - 0xe0000000
```

```
  next hop 10.0.0.1/32 via 24003/0/21
```

```
    next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}
```

```
via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
```

```
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
```

```
  recursion-via-/32
```

```
  next hop VRF - 'default', table - 0xe0000000
```

```
  next hop 10.0.0.2/32 via 24001/0/21
```

```
    next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}
```

```
via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
  path-idx 2 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2550
```

```
  recursion-via-/32
```

```
  next hop VRF - 'default', table - 0xe0000000
```

```
  next hop 10.0.0.4/32 via 24000/0/21
```

```
    next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}
```

```
via 10.0.0.5/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
  path-idx 3 NHID 0x0 [0xdab2368 0x0], Internal 0xd6a2910
```

```
  recursion-via-/32
```

```
  next hop VRF - 'default', table - 0xe0000000
```

```
  next hop 10.0.0.5/32 via 24005/0/21
```

```
    next hop 10.5.101.5/32 Gi0/0/0/1 labels imposed {ImplNull 24014}
```

检验通告的路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Process          bRIB/RIB  SendTblVer
```

```
Speaker          235      235
```

```
Last Modified: Sep 18 06:22:24.649 for 00:03:59
```

```
Paths: (4 available, best #1)
```

```
Not advertised to any peer
```

```
Path #1: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```

```
10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
```

```
  Received Label 24012
```

```
  Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported
```

```
  Received Path ID 1, Local Path ID 1, version 235
```

```
  Extended community: RT:65000:1
```

```
  Originator: 10.0.0.1, Cluster list: 10.0.0.101
```

```
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```



```

10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 2, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Originator: 10.0.0.4, Cluster list: 10.0.0.101
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.5 (metric 3) from 10.0.0.101 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 3, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Originator: 10.0.0.5, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local
  10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 4, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Originator: 10.0.0.2, Cluster list: 10.0.0.101
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

结论:

- 所有3条路径在BGP中都标记为多路径。
- 3个ECMP路径安装在RIB/CEF表中。
- 第二条路径是备份路径。在BGP中标记为备份（保护多路径），并在RIB/CEF表中安装为备份路径。
- 通告最佳路径、多路径路径和“备份（保护多路径）”路径。

## 自Cisco IOS®-XR 7.3.1起的新路径选择行为

从Cisco IOS®-XR 7.3.1开始，情况已发生变化：

- 可以选择每个邻居路径。在Cisco IOS®-XR 7.3.1之前，这只是每个地址系列。
- 一个路由策略中允许多条设置路径选择语句。
- BGP路径可以按接收顺序显示。

### 可以选择每个邻居路径

以下是路由策略中可用的路径选择：

```

RP/0/RP0/CPU0:RR(config-rpl)#set path-selection ?
all          BGP all paths
backup      BGP backup path
best-path   BGP best path
group-best  BGP group best path
multipath   BGP multipath

```

最佳路径为默认值。

地址系列级别支持此功能。

配置示例：

```
router bgp 65000
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 additional-paths receive
 additional-paths send
   additional-paths selection route-policy BGP-Path-Selection
 !
 neighbor 10.0.0.1
 remote-as 65000
 update-source Loopback0
 address-family ipv4 unicast
   route-reflector-client
 !
 address-family vpnv4 unicast
   route-reflector-client
 !
!
vrf one
 rd 1:1
 address-family ipv4 unicast
   maximum-paths ibgp 2
   additional-paths selection route-policy BGP-Path-Selection
   redistribute connected
 !
 !
!
```

从Cisco IOS®-XR 7.3.1开始，路由策略中的一些路径选择选项在邻居级别也受支持。这会导致对向哪些BGP邻居通告哪些路径进行更精细的控制。例如，BGP发言者可能会向一个BGP邻居通告最佳路径和一个备份路径，但会通告多路径并保护多路径路径到另一个邻居。

在邻居级别，有：

```
RP/0/RP0/CPU0:RR(config-rpl)#if destination ?
in                               Member of a set
  is-all                          Check for additional paths selected by all path-selection
  is-backup-path                   Checks for backup path
is-best-external                 Checks for best external route
  is-best-path                     Checks for best path
  is-multi-path                     Checks for multiple paths
  is-multipath-protect             Checks for multipath-protect path
longer-than                       Prefix-length greater than the route's prefix length
or-longer                         Prefix-length equal to or greater than the route's prefix length
```

**警告：**如果配置了BGP命令maximum-path，则最佳路径是多路径。但是，如果路由策略中配置的唯一条件是**多路径**，则只通告不是最佳路径的多路径！它取决于BGP设计，但是，如果应通告多路径，则也应通告最佳路径。

is-all 和is-multipath-protect 是Cisco IOS®-XR 7.3.1新推出的。

**一个路由策略中允许多条集路径选择语句**

自Cisco IOS®-XR 7.3.1起，您可以在一个与一个前缀相关的路由策略中拥有多个路由选择语句。在Cisco IOS®-XR 7.3.1之前，这是不允许的，并且会导致无法预测的BGP路径行为。

查看每个前缀是否有多个路径选择。

例如，在Cisco IOS®-XR 7.3.1之前，不支持以下功能：

```
route-policy add-path-to-ibgp
  set weight 65000
  set path-selection backup 1 install
  set metric-type type-1
  set extcommunity rt RT BUSINESS additive
  set path-selection all advertise
  set rib-metric 100
end-policy
```

在一个路由策略中有两条set path-selection语句应用于相同的前缀。

但是，在Cisco IOS®-XR 7.3.1之前，支持以下内容。原因是不同的路径选择语句用于不同的前缀，因为如果使用了具有选择的语句（目标、社区、...）。

示例 1：

```
route-policy ADDPATH
  if destination in TRAFFIC_1 then
    set path-selection backup 1 install
  endif
  if destination in TRAFFIC_2 then
    set path-selection multipath advertise
  endif
end-policy
```

这很好，因为set-path select语句与不同的前缀相关(它们位于两个不同的if语句中)。

示例 2：

```
route-policy ADDPATH-2
  if community matches-any COMM_ADD-PATH then
    set path-selection backup 1 install multipath-protect advertise
  else
    set path-selection best-path
  endif
end-policy
```

这很好，因为设置路径选择语句与不同的前缀相关(它们位于if语句的两个不同部分中)。

从Cisco IOS®-XR 7.3.1开始，支持此功能。

以下是具有多条set path-selection语句的路由策略的示例：

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```

每邻居路由策略指定向该邻居通告哪些路径。只能从地址系列级别上已标记的路径中选择任何路径

o

在地址系列级别，您有路径选择：

```
RP/0/RP0/CPU0:RR(config-rpl)#set path-selection ?
all          BGP all paths
backup       BGP backup path
best-path    BGP best path
group-best   BGP group best path
multipath    BGP multipath
```

在邻居级别，有：

```
RP/0/RP0/CPU0:RR(config-rpl)#if destination ?
in           Member of a set
  is-all      Check for additional paths selected by all path-selection
  is-backup-path Checks for backup path
is-best-external Checks for best external route
  is-best-path Checks for best path
  is-multi-path Checks for multiple paths
  is-multipath-protect Checks for multipath-protect path
longer-than  Prefix-length greater than the route's prefix length
or-longer    Prefix-length equal to or greater than the route's prefix length
```

**警告：**如果配置了BGP命令maximum-path，则最佳路径是多路径。但是，如果路由策略中配置的唯一条件是**多路径**，则只通告不是最佳路径的多路径！它取决于BGP设计，但是，如果应通告多路径，则也应通告最佳路径。

is-all 和is-multipath-protect 是Cisco IOS®-XR 7.3.1新推出的。

使用此方法，路径选择的标记可以是您拥有的路径选择模式（例如，所有备份、多路径、多路径保护等）的混合。

邻居策略基于路径选择标记控制通告。

对于标记部件：例如，可以在地址系列级别的路由策略中同时配置备份和多路径：

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise (1)
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
(2)
end-policy
!
```

以上两条set path-selection语句是从Cisco IOS®-XR 7.3.1开始新支持的语句。在本例中仍配置maximum-path ibgp 3的情况下，您有以下语句：

- 允许通告最佳路径和所有多路径路径。
- 允许通告最佳路径和备份（保护多路径）路径。

在Cisco IOS®-XR 7.3.1之前，此组合是不可能的。这意味着(1)或(2)将生效。

结果是：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

Last Modified: Sep 18 06:59:27.907 for 00:00:28

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):  
0.2 0.3

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):  
0.2 0.3

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, multipath,

import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to update-groups (with more than one peer):  
0.2

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath, backup**, add-path,

import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Advertised to update-groups (with more than one peer):  
0.2

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,

add-path, import-candidate, imported

Received Path ID 0, Local Path ID 3, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Advertised to update-groups (with more than one peer):  
0.2

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-

candidate, imported

Received Path ID 0, Local Path ID 4, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #5: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 1, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

Routing entry for 10.1.1.1/32

Known via "bgp 65000", distance 200, metric 0

Number of pic paths 1 , type internal

Installed Sep 18 06:59:27.833 for 00:01:59

Routing Descriptor Blocks

10.0.0.1, from 10.0.0.1, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.2, from 10.0.0.2, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.3, from 10.0.0.3, **BGP backup path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

10.0.0.4, from 10.0.0.4, **BGP multi path**

Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000

Route metric is 0

No advertising protos.

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 409, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e1168)

Updated Sep 18 06:59:27.836

Prefix Len 32, traffic index 0, precedence n/a, priority 3

via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.1/32 via 24003/0/21

next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24012}

via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.2/32 via 24001/0/21

next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24012}

via 10.0.0.3/32, 2 dependencies, recursive, **backup** [flags 0x6100]

path-idx 2 NHID 0x0 [0xdab2060 0x0]

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.3/32 via 24007/0/21

next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24012}

via 10.0.0.4/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]

path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2370

recursion-via-/32

next hop VRF - 'default', table - 0xe0000000

next hop 10.0.0.4/32 via 24000/0/21

next hop 10.4.101.4/32 Gi0/0/0/7 labels imposed {ImplNull 24013}

检验通告的路径：

RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process bRIB/RIB SendTblVer

Speaker 271 271

Last Modified: Sep 18 06:59:28.649 for 00:01:53

Paths: (4 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

```

Local
 10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
   Received Path ID 1, Local Path ID 1, version 271
   Extended community: RT:65000:1
   Originator: 10.0.0.1, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Not advertised to any peer
Local
 10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 2, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Originator: 10.0.0.2, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local
 10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 3, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Originator: 10.0.0.3, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local
 10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
   Received Label 24013
   Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
   Received Path ID 4, Local Path ID 0, version 0
   Extended community: RT:65000:1
   Originator: 10.0.0.4, Cluster list: 10.0.0.101
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

现在，可以根据is-best-path或is-backup-path向一个邻居通告主路径（最佳路径）和备份路径。

对于另一个邻居，可以使用is-multi-path通告多路径。

邻居路由策略示例（与地址系列级别的路由策略一起使用）：

```

route-policy BGP-neighbor-1
if community matches-any COMM-LIST-1 then
  if destination is-best-path or destination is-backup-path then
    pass
  else
    drop
  endif
elseif community matches-any COMM-LIST-2 then
if destination is-multi-path or destination is-multipath-protect then
  pass
else
  drop
endif
else
  drop
endif

```

end-policy

!

如果路由反射器具有以下BGP路径：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 18 07:14:32.907 for 00:06:53

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):  
0.3

Advertised to peers (in unique update groups):

10.0.0.6 10.0.0.5

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):  
0.3

Advertised to peers (in unique update groups):

10.0.0.6 10.0.0.5

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**,

import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.6 10.0.0.5

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path,

import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-

candidate, imported

Received Path ID 0, Local Path ID 4, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,

add-path, import-candidate, imported

Received Path ID 0, Local Path ID 3, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1



```
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

然后，对于邻居路由策略的第一条路径，即：

```
if destination is-best-path or destination is-backup-path then
  pass
```

邻居PE6接收以下路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
Speaker          283      283
```

```
Last Modified: Sep 18 07:14:33.649 for 00:07:21
```

```
Paths: (2 available, best #1)
```

```
Not advertised to any peer
```

```
Path #1: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```

```
  10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
```

```
    Received Label 24012
```

```
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported
```

```
    Received Path ID 1, Local Path ID 1, version 283
```

```
    Extended community: RT:65000:1
```

```
    Originator: 10.0.0.1, Cluster list: 10.0.0.101
```

```
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local
```

```
  10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
```

```
    Received Label 24012
```

```
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
    Received Path ID 2, Local Path ID 0, version 0
```

```
    Extended community: RT:65000:1
```

```
    Originator: 10.0.0.2, Cluster list: 10.0.0.101
```

```
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

这两条路径是RR上的最佳路径和备份路径。

对于邻居路由策略的第二部分，如下所示：

```
if destination is-multi-path or destination is-multipath-protect
then
  pass
```

邻居PE6接收以下路径：

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```
Process          bRIB/RIB  SendTblVer
Speaker          299      299
```

Last Modified: Sep 18 07:31:09.649 for 00:02:29

Paths: (3 available, best #1)

Not advertised to any peer

Path #1: Received by speaker 0

Not advertised to any peer

Local

10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-candidate, imported

Received Path ID 2, Local Path ID 1, version 299

Extended community: RT:65000:1

Originator: 10.0.0.2, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local

10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 3, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.4, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local

10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 4, Local Path ID 0, version 0

Extended community: RT:65000:1

Originator: 10.0.0.3, Cluster list: 10.0.0.101

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

这些路径是多路径路径(但不包括最佳路径!)和备份(保护多路径)路径。

## 按接收顺序显示BGP路径

BGP路径按字典顺序显示。

Cisco IOS®-XR 7.3.1中引入的新命令可用于按接收顺序查看BGP路径：

```
show bgp <afi> rd <rd> <path_details> <age-order>
```

此命令有助于查看路径被标记为多路径的原因。之前收到的路径标记为多路径，并作为最大路径路由安装在RIB中。**show route**命令显示**BGP multi path**关键字，用于这样安装的路由。

为了检验哪条路径被标记为多路径，新命令可用于检验所有路径的接收顺序。较新的路径位于输出顶部。

例如，使用以下配置：

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise
```

```
set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
```

!

最佳路径决策过程没有变化，路径也没有任何影响最佳路径决策过程的属性（如本地首选项）。

路由反射器具有以下BGP路径选择：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

Last Modified: Sep 18 08:46:11.907 for 00:03:43

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.3

Advertised to peers (in unique update groups):

10.0.0.5

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.3

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**,

import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path,

import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.5 10.0.0.6

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-

candidate, imported

Received Path ID 0, Local Path ID 3, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Advertised to peers (in unique update groups):

10.0.0.5 10.0.0.6

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,

add-path, import-candidate, imported

```

Received Path ID 0, Local Path ID 4, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

为什么从10.0.0.1开始的路径是最佳路径？为什么从10.0.0.2开始的路径是备份路径？为什么从10.0.0.3多路径发出路径？为什么从10.0.0.4开始的路径是备份（保护多路径）？为什么从10.0.0.5开始的路径不是最佳路径，不是多路径，而不是备份（保护多路径）路径？

您可以使用相同的命令在末尾显示age-order。较新的路径位于输出顶部。

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
Process          bRIB/RIB  SendTblVer
Speaker          5         5
  Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 07:31:07.907 for 00:23:23
Paths: (5 available, best #3)
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.5
Path #1: Received by speaker 0
Flags: 0x2000000084060205, import: 0x96
Advertised to peers (in unique update groups):
  10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
  Received Path ID 0, Local Path ID 3, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Flags: 0x2000000084020205, import: 0x96
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.5
Local, (Received from a RR-client)
  10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000

```

```

Received Label 24012
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
Received Path ID 0, Local Path ID 1, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
Received Label 24012
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
Received Path ID 0, Local Path ID 4, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
Received Label 24012
Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
Received Path ID 0, Local Path ID 2, version 5
Extended community: RT:65000:1
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

您可以使用show bgp命令和关键字**bestpath-compare**来验证路径为什么不是最佳路径（每个路径显示一个原因）。

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 bestpath-compare
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
Process          bRIB/RIB  SendTblVer
Speaker          5         5
Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 07:31:07.907 for 00:44:59
Paths: (5 available, best #1)
Advertised to update-groups (with more than one peer):
 0.3
Advertised to peers (in unique update groups):
 10.0.0.5
Path #1: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
 0.3
Advertised to peers (in unique update groups):
 10.0.0.5
Local, (Received from a RR-client)
 10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
Received Label 24012
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
Received Path ID 0, Local Path ID 1, version 5
Extended community: RT:65000:1
best of local AS, Overall best
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0

```

```

Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
  Received Path ID 0, Local Path ID 2, version 5
  Extended community: RT:65000:1
  iBGP multi-path
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
  Received Path ID 0, Local Path ID 4, version 5
  Extended community: RT:65000:1
  iBGP multi-path
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Flags: 0x2000000084060205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
  Received Path ID 0, Local Path ID 3, version 5
  Extended community: RT:65000:1
  Higher router ID than best path (path #1)
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Flags: 0x2000000084020205, import: 0x96
Not advertised to any peer
Local, (Received from a RR-client)
 10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
  Received Label 24014
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Higher router ID than best path (path #1)
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

由于BGP路径中的大多数属性在路径之间是相等的，因此选择最佳路径的决定将落到BGP发言者的最低路由器ID。这是BGP扬声器10.0.0.1。备份路径是第二最佳路径，因此是BGP扬声器的第二最低路由器ID。这是10.0.0.2。

来自10.0.0.4和10.0.0.5的路径不是多路径路径，因为它们的安装时间晚于来自10.0.0.1、10.0.0.2和10.0.0.3的路径。

## 备份与备份 ( 保护多路径 ) 路径

```

route-policy BGP-Path-Selection
  set path-selection multipath advertise

```

```
set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
```

!

配置了最大路径ibgp 3。

备份是第二佳路径。在此，在备用路径之前已接收多路径。因此，有三条多路径，另一条是备用路径。

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order
```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1

Versions:

```
Process          bRIB/RIB  SendTblVer
Speaker          5         5
```

Flags: 0x240692b2+0x00010000; multipath; backup available;

Last Modified: Sep 18 08:51:17.907 for 00:07:11

Paths: (5 available, best #3)

Advertised to update-groups (with more than one peer):

0.3

Advertised to peers (in unique update groups):

10.0.0.5

Path #1: Received by speaker 0

Flags: 0x2000000084020205, import: 0x96

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 0, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Flags: 0x2000000084060205, import: 0x96

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **backup**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Flags: 0x2000000085070205, import: 0x9f

Advertised to update-groups (with more than one peer):

0.3

Advertised to peers (in unique update groups):

10.0.0.5

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, multipath, import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Flags: 0x2000000084070205, import: 0x96

Advertised to peers (in unique update groups):

10.0.0.6

```

Local, (Received from a RR-client)
 10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
   Received Label 24014
   Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
   Received Path ID 1, Local Path ID 3, version 5
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
 10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
   Received Path ID 0, Local Path ID 4, version 5
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

关闭邻居10.0.0.5。现在您有：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process          bRIB/RIB  SendTblVer
 Speaker          7         7
   Flags: 0x2406b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 09:05:07.907 for 00:00:23
Paths: (4 available, best #3)
Advertised to update-groups (with more than one peer):
 0.3
Path #1: Received by speaker 0
Flags: 0x2000000084060205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6
Local, (Received from a RR-client)
 10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
   Received Label 24013
   Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
   Received Path ID 0, Local Path ID 5, version 7
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6
Local, (Received from a RR-client)
 10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
   Received Label 24012
   Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
   Received Path ID 0, Local Path ID 2, version 7
   Extended community: RT:65000:1
   Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
 0.3
Local, (Received from a RR-client)

```



```

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
  Received Path ID 0, Local Path ID 1, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
  10.0.0.6
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
  Received Path ID 0, Local Path ID 4, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

- 从10.0.0.5开始的路径消失了。
- 从10.0.0.2开始的路径仍是备份路径，但现在也是多路径路径。
- 由于备份路径也是多路径路径，因此您现在拥有备份（保护多路径）路径。这是从10.0.0.4开始的路径。

取消关闭邻居10.0.0.5:

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          10        10
  Flags: 0x2406b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 09:08:42.907 for 00:00:00
Paths: (5 available, best #4)
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.5
Path #1: Received by speaker 0
Flags: 0x2000000084020205, import: 0x96
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
  Received Label 24014
  Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
  Received Path ID 1, Local Path ID 0, version 0
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Flags: 0x2000000084060205, import: 0x96
Advertised to peers (in unique update groups):
  10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
  Received Path ID 0, Local Path ID 5, version 7
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

```

Path #3: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
  10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
  Received Path ID 0, Local Path ID 2, version 10
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.5
Local, (Received from a RR-client)
  10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
  Received Path ID 0, Local Path ID 1, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
  10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
  Received Path ID 0, Local Path ID 4, version 5
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

之前安装的4条路径没有更改。仅添加了10.0.0.5的路径。它位于顶部，因为它较新。它不是多路径或任何类型的备份路径。

在路径状态发生变化后，从10.0.0.5开始的路径已从多路径变为非多路径！

结论:

- 接收路径的顺序在确定哪些路径是多路径时起着作用。
- 如果存在备份（保护多路径）路径，则路径的接收顺序将起到作用。
- 路径的接收顺序与选择路径作为最佳路径或备份路径的角色无关。

## 按IGP指标排序

有一个选项可根据内部网关协议(IGP)度量对多路径进行排序。

```

RP/0/RP0/CPU0:RR#conf t
RP/0/RP0/CPU0:RR(config)#router bgp 65000
RP/0/RP0/CPU0:RR(config-bgp)#vrf one
RP/0/RP0/CPU0:RR(config-bgp-vrf)#address-family ipv4 unicast
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost ?

```

```

deterministic Deterministic Multipath selection primarily on IGP metric order
selective Allow multipaths only from marked neighbors
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost deterministic ?
selective Allow multipaths only from marked neighbors
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost deterministic
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#commit
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#end
RP/0/RP0/CPU0:RR#

```

因为多路径需要相同的IGP开销才能被视为多路径，所以您最终只拥有最佳路径、备份路径，但没有多路径。

从RR到PE路由器的IGP开销在拓扑中发生更改。IGP开销配置如下：

- RR到PE1:5
- RR到PE2:4
- RR到PE3:3
- RR到PE4:2
- RR到PE5:1

还有以下几点：

```

route-policy BGP-Path-Selection
  set path-selection multipath advertise
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!

```

在IGP度量（所有链路的开销相同）更改之前：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
  Process          bRIB/RIB   SendTblVer
  Speaker          10         10
Last Modified: Sep 18 09:08:42.907 for 05:26:53
Paths: (5 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.3
  Advertised to peers (in unique update groups):
    10.0.0.5
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.3
  Advertised to peers (in unique update groups):
    10.0.0.5
  Local, (Received from a RR-client)
    10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
    Received Path ID 0, Local Path ID 1, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0
  Advertised to peers (in unique update groups):
    10.0.0.5      10.0.0.6

```

```

Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
    Received Path ID 0, Local Path ID 2, version 10
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Advertised to peers (in unique update groups):
  10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
    Received Path ID 0, Local Path ID 4, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Advertised to peers (in unique update groups):
  10.0.0.5      10.0.0.6
Local, (Received from a RR-client)
  10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
    Received Label 24013
    Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
    Received Path ID 0, Local Path ID 5, version 7
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

在IGP指标更改后：

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
```

```
Process          bRIB/RIB  SendTblVer
```

```
Speaker          14        14
```

```
Flags: 0x2486b2b2+0x00010000; multipath; backup available;
```

```
Last Modified: Sep 18 16:09:45.907 for 00:01:10
```

```
Paths: (5 available, best #2)
```

```
Advertised to update-groups (with more than one peer):
```

```
0.3
```

```
Path #1: Received by speaker 0
```

```
Flags: 0x2000000084020205, import: 0x94
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 6) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
Received Path ID 1, Local Path ID 0, version 0
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```

Path #2: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
  0.3
Local, (Received from a RR-client)
  10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
  Received Label 24014
  Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
  Received Path ID 1, Local Path ID 1, version 11
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Flags: 0x2000000084060205, import: 0x94
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.6
Local, (Received from a RR-client)
  10.0.0.2 (metric 5) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
  Received Path ID 1, Local Path ID 3, version 10
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Flags: 0x2000000084070205, import: 0xd4
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.6
Local, (Received from a RR-client)
  10.0.0.4 (metric 3) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
  Received Label 24013
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
  Received Path ID 1, Local Path ID 5, version 14
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Flags: 0x2000000084070205, import: 0x94
Advertised to update-groups (with more than one peer):
  0.3
Advertised to peers (in unique update groups):
  10.0.0.6
Local, (Received from a RR-client)
  10.0.0.3 (metric 4) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
  Received Path ID 1, Local Path ID 4, version 10
  Extended community: RT:65000:1
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

```

- 由于IGP度量 (度量2) 较低, 因此最佳路径是10.0.0.5的路径。
- 现在, 备份路径是具有第二最佳IGP度量的路径, 即10.0.0.4 (度量3) 的路径。
- 最佳路径和备用路径也是多路径, 因此仍需选择一条多路径路径。这是从10.0.0.3 (度量4) 开始的路径。
- 备份 (保护多路径) 路径是10.0.0.2 (度量5) 的路径。
- 最后, 10.0.0.1 (度量6) 的路径没有标记, 因为它具有最差度量。